(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 303 078 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.04.2003 Bulletin 2003/16

(51) Int Cl.[7]: **H04L 12/10**, H04L 12/413

(21) Application number: **01440343.0**

(22) Date of filing: **15.10.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

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(54) Alarm of a telecommunications terminal connected to a LAN

(57) It is advantageously taken profit of the fact that before any supply of remote power to a telecommunications terminal connected to a local area network, the Ethernet equipment must recognize the power class of said terminal by measuring a specific electrical signature of said terminal via their interconnection. In the case said Ethernet equipment will stand in a situation unable to supply the required power, then it will send a specific signal via said interconnection which will activate an alarm on said terminal. The possibility to be alerted by a specific alarm from said terminal in the case no remote power can be supplied to it, will advantageously inform the user of that terminal about the powering situation. This will prevent any confusion about the reason of a wrong running of that terminal and may allow to look for an alternative.

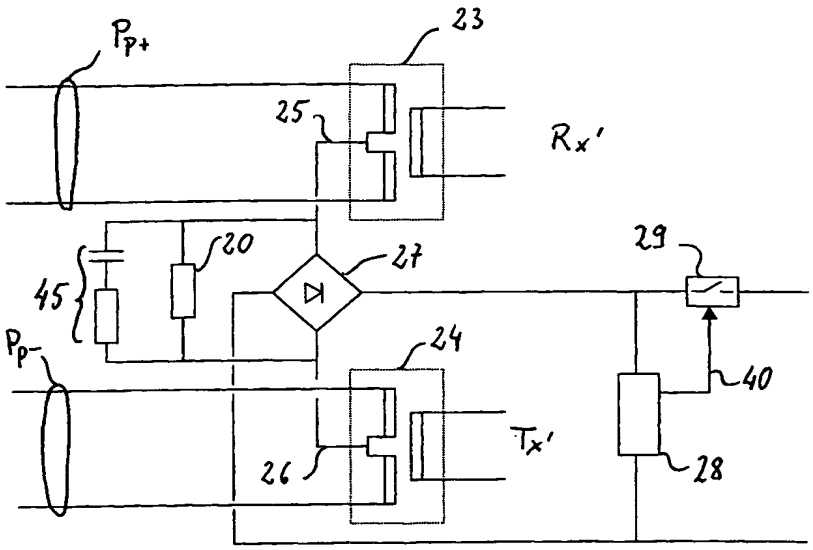

Figure 2

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Description

[0001] The present invention relates generally to a data processing local area network LAN, for example an Ethernet network. To be more precise, the invention relates to a method of providing a signal to a terminal in a LAN as set forth in the preamble of claim 1, a terminal adapted to implement this method and an Ethernet equipment as set forth respectively in the preamble of claim 6 and 10.

[0002] The growth of the Internet and similar local and wide area networks (LAN and metropolitan ones) based on Ethernet technology has created a potential market for telecommunications systems to be connected directly to such networks. A typical Ethernet connection to an office location with a telecommunications system is usually based on the use of half of the 8 wires of a line L separated in two unshielded twisted pair of wires giving - one pair for transmission Tx, one for reception Rx. The transmission pair is dedicated to send packets of data over the Ethernet connection; the reception pair receives packets of data over the Ethernet connection. The four other wires are usually not used for data transmission.

[0003] On the IEEE forum 802.3 (Ethernet) was set a subgroup 802.3af dealing with remote powering of data terminal equipment DTE connected to an Ethernet interface i.e. a DTE powered by a media dependent interface MDI.

[0004] There is discussed the possibilities and feasibility to remotely power a terminal via center taps using two pairs of wires of the line L as conductors of a phantom circuit. Particularly in US6,115,468 is disclosed an Ethernet device power transmission system providing electrical power to telecommunications terminals such as Ethernet telephones and related equipment over a 4-wire Ethernet connection. This is achieved without the need for rewiring premises having an existing 4-wire Ethernet system. This system includes an input transformer, an output transformer and a pair of twisted pair conductors. The input transformer includes a pair of primaries for connection to a source of Ethernet data. The input transformer also includes a pair of secondaries, each having a center-tap. A first twisted pair conductor is connected across the first secondary, a second twisted pair conductor is connected across the second secondary and a DC-bias is provided between the respective center taps of the first and second secondaries. At the local end, the output transformer includes a first and second center-tapped primary and a first and second secondary for connection to the load device. The first and second primary center taps are connected to a power processor for extraction of DC power.

[0005] In EP1100226 is disclosed a more specific method of providing a remote power feed to a telecommunications terminal over an Ethernet connection. Previously sending a power supply current over that connection, at least one detection signal on at least two conductors of that connection is fed for detecting the presence of a telecommunications terminal adapted to receive a remote power feed. Applying such method shall prevent all risk to such terminal because the remote power feed current is sent only if the terminal has been identified as one which is adapted to receive a remote power feed. The intensity and duration of the detection signal are chosen so that the operation of detecting the terminal cannot cause any damage if it is not one which is adapted to receive a remote power fed.

[0006] The detection signal characterizing said DTE is defined by a signature usually an impedance of a predefined value connected to the two center taps of the transformers to which the two pairs of wires are connected. On the above cited IEEE forum are set values of impedance for each different power class of terminals to be connected to a LAN. In case said DTE is connected to the LAN via a RJ-45 connector i.e. via a line L made of two couples of two pairs of wires, then the same impedance is also connected to the two center taps of the transformer to which the two pairs of the other couple are connected. After the correct recognition of the power class of the DTE, the required power supply will be applied on one or both of the two couples of two pairs of wires used possibly as conductors of a phantom circuit. Moreover, the DTE contains two detectors each one connected at the two center taps corresponding to a couple of two pairs of wires. These detectors measure the corresponding voltage present at the respective two center taps. When such measure exceeds a predefined value then they activate a respective switch letting said power supply remotely powering said DTE.

[0007] A problem will appear when the required power for a specific terminal can not be supplied by any Ethernet equipment coupled to said DTE via said line. This may occur when the power class of the DTE will exceed the maximum power which can be supplied by the corresponding Ethernet equipment. In that case, no power at all will be supplied to this DTE. And the user of such DTE will not be aware about the origin of the power supply problem. He/she may believe of a breakdown of its terminal or the line.

[0008] It is an object of the present invention to develop a method and a terminal which will give a possibility for the user of such telecommunications terminal to recognize the situation when no remote power can be supplied to such terminal.

[0009] This object is attained by a method of providing a signal to a terminal in a local area network as claimed in claim 1, a terminal adapted to performed such method and an Ethernet equipment as claimed respectively in claim 6 and 10.

[0010] It is advantageously taken profit of the fact that before any supply of remote power to a telecommunications terminal connected to a local area network, the Ethernet equipment must recognize the power class of said terminal by measuring a specific electrical signature of said terminal via their interconnection. In the case

said Ethernet equipment will stand in a situation unable to supply the required power, then it will send a specific signal via said interconnection which will activate an alarm on said terminal.

[0011] The possibility to be alerted by a specific alarm from said terminal in the case no remote power can be supplied to it, will advantageously inform the user of that terminal about the powering situation. This will prevent any confusion about the reason of a wrong running of that terminal and may allow to look for an alternative.

[0012] Further advantageous features of the invention are defined in the dependent claims and will become apparent from the following description and the drawings.

[0013] Two embodiments of the invention will now be explained in more details with reference to the accompanying drawings, in which:

Fig. 1 is a schematic view of a terminal connected via a line L to some power supply equipment;

Fig. 2 is a schematic view of a terminal according to a first embodiment of the invention;

Fig. 3 is a schematic view of a terminal according to a second embodiment of the invention.

[0014] Figure 1 is a schematic view of a terminal DTE, usually a telecommunications terminal like an IP-phone connected to a local area network via a line L. Such terminal DTE which can be remotely powered is then coupled via L to some Ethernet equipment 3. Said terminal DTE will be remotely powered by some remote power feed unit 31 possibly located in such Ethernet equipment 3 being a switch, a concentrator or a repeater (also known as a hub). Latter is then used to supply or transfer remotely some power to said terminal DTE.

[0015] A line L, typically, is made of 8 wires divided in two couples of two pairs of wires Pp+, Pp-; Pa+, Pa-. One Pp+, Pp- of the two couples is used for data transfer between the LAN and said terminal DTE. For example, a pair Pp+ is used to send data from the LAN i.e. from the Ethernet equipment 3 towards Rx' the terminal DTE. And the other pair Pp- of wires from this couple is used to send data from the terminal DTE towards Tx' the LAN. The other couple of the two pairs Pa+, Pa- of wires which are connected at Ethernet equipment 3 side to some units not shown on the figure 1 may be let unused.

[0016] In figure 1, the remote power feed is provided via a common mode phantom circuit. Each pair of wires of the used couple Pp+, Pp- are connected to some transformer 33, 34 of a center tap transformer 32 from said Ethernet equipment 3 and on the terminal DTE side to some transformer 23, 24 respectively of a center tap transformer 22. Power supply for remotely powering said terminal DTE will be applied by said power feed unit 31 at center taps 35, 36 of the used transformer 33, 34. This supply power will be collected by some collector 21 in the terminal DTE at center taps 25, 26 of the respective transformer 23, 24 from its center tap transformer 22. And the couple of pairs of wires Pp+ and Pp- will then be used as conductors of a phantom circuit.

[0017] The power feed unit 31 is adapted to detect the presence of a terminal being able to be remotely powered. This is performed by sending some signal allowing to recognize some electrical signature usually an impedance 20 connected to the center taps 25, 26 of the transformer 23, 24 of the terminal specific for such terminal. The value of the measured impedance 20 will then define the amount of power required by said terminal DTE to be supplied by said power feed unit 31.

[0018] In a variant, the power feed unit 31 and the center tap transformer 32 can be in a separate module and completely independent of the Ethernet equipment 3, that module being simply inserted into the line L.

[0019] In figure 2 and 3 are shown schematically the interface of a terminal DTE to the line L according to two different embodiments of the invention. In both embodiments, the terminal DTE is connected in a same way to the line L via the transformers 23, 24 to which are connected the couple of pairs Pp+, Pp- of wires. The impedance 20 is connected in parallel to a rectifier bridge 27 connected itself to the two center taps 25, 26 of the transformer 23, 24 of the terminal center tap transformer 22. A switch 29 is connected after the rectifier bridge 27 and before the collector 21 (not shown on the figure 2 and 3) to allow to disconnect that collector 21 from the phantom circuit. Said switch 29 is controlled 40 by some detector 28 connected to the terminals of the rectifier bridge 27. That detector analyzes the power present on the line L and accordingly activates or inhibits 40 the switch 29.

[0020] The switch 29 shall stay in an open stage when no adequate remote powering is present on the line L. Indeed, when the Ethernet equipment 3 sends some signals to measure the electrical signature of said terminal DTE, the switch 29 being open will hide the collector 21 so to allow a sure a rapid measurement of the corresponding impedance 20. Therefore, it is possible to set up the detector 28 to keep the switch 29 in an open stage in any case when the power present on the phantom circuit is lower than a predefined value - threshold voltage - corresponding to a correct remote powering of said terminal DTE. As soon as the power exceeds said threshold voltage, the detector 28 will then activate 40 the switch 29 to allow the collector 21 to receive the power required for a correct running of said terminal DTE.

[0021] According to the present invention, in case the Ethernet equipment 3 is unable to supply the required power for that terminal DTE, it will send some specific signal via the same phantom circuit to alert said terminal DTE about the situation. This signal is performed by some electrical circuit, possibly the same which had send before some recognition signal to said terminal DTE via the line L as a measure of said electrical signa-

ture 20. The alert signal will then notify to said terminal DTE of the incapacity to be remotely powered.

[0022] The terminal DTE according to the present invention will be able to detect such alert signal using some detector 45, 46. In a first embodiment according to the invention, this alert signal is sent using an alternating voltage over a short time. This alternating signal after being rectified by the rectifier bridge 27, must give a direct voltage low enough not to be mix up by the detector 28 as a remote powering. Such signal will be detected by a detector 45 connected in parallel to the impedance 20 as shown in figure 2.

[0023] In a second embodiment according to the invention, this alert signal is sent using a direct voltage. The voltage value will be greater as the one used to recognize the impedance 20 but lower than the one for a remote powering of said terminal DTE. Such signal can be detected by the detector 28 or a further detector 46 connected to said detector 28 as shown in figure 3.

[0024] In both cases, the alert signal when detected by the respective detector 45, 46 will activates some alarm. This alarm can be of the kind of an activated buzzer or the flashing of some light like a LED or even the notification of some message on a display of said terminal DTE. In any case, the chosen alarm must be easily recognizable by the user of said terminal DTE as being a specified alarm when a remote powering of the terminal via the line L is not possible. In that case, the user may be in a possibility to look for alternatives like to find another power supply (local one) or another terminal. Advantageously, the user will not be confused in believing that its terminal is broken and be accordingly fully informed about the reason of the wrong running.

[0025] In the case that the terminal DTE may be possibly alternatively powered via a local supply i.e. not using any remote powering via the line L, then such local powering can be used to run the alarm after detection of the alert signal. This will then allow to use some alarm which are more power demanding like displaying some more complex message informing the user of the impossibility to let remotely powering its terminal DTE.

Claims

1. Method of providing a signal to a terminal (DTE) in a local area network LAN, said terminal (DTE) being connected to an Ethernet equipment (3) of said LAN via a line (L) including two pairs of wires (Pp+, Pp-), each pair being respectively coupled to transformers (23, 24) of a center tap transformer (22) of said terminal (DTE), such that on one (Pp+) of said pairs data will be send from a center tap transformer (32) of said Ethernet equipment (3) to said center tap transformer (22) of said terminal (DTE) and on the other one (Pp-) data will be send in the opposite direction, and each pair of wires (Pp+, Pp-) being possibly used as conductors of a phantom circuit, while

   a signal will be send by said Ethernet equipment for a recognition of an electrical signature (20) specifying a power class of said terminal (DTE) at which it shall be remotely powered by said Ethernet equipment (3)

   characterized in, that

   when said Ethernet equipment (3) will be unable to supply the required power for said terminal (DTE), then said Ethernet equipment (3) will send via said line (L) a specific signal notifying to said terminal (DTE) of the incapacity to be remotely powered.

2. Method of providing a signal according to claim 1 **characterized in, that** said specific signal will activate some alarm of said terminal (DTE).

3. Method of providing a signal according to claim 1 **characterized in, that** said signal is detected by a detector (45, 46) connected at center taps (25, 26) of the respective transformers (23, 24) of the terminal center tap transformer (22), said detector (45, 46) activating said alarm after recognizing said signal.

4. Method of providing a signal according to one of the claim 1 to 3 **characterized in, that** said signal is an alternating one which activates a detector (45) connected in parallel to said electrical signature (20).

5. Method of providing a signal according to one of the claim 1 to 3 **characterized in, that** said signal is a direct one which activates a detector (46) connected at the terminals of a rectifier bridge (27) which is itself connected at the two center taps (25, 26) of the transformer (23, 24) of the terminal center tap transformer (22).

6. Terminal (DTE) adapted to be connected to a local area network LAN and to receive remote power supply via the same line (L) including two pairs of wires (Pp+, Pp-), each pair being respectively coupled to transformers (23, 24) of a center tap transformer (22) of said terminal (DTE) and being possibly used as conductors of a phantom circuit, and said terminal (DTE) comprising an electrical signature (20) connected at two center taps (25, 26) of the transformers (23, 24) of the terminal center tap transformer (22), while said electrical signature (20) is to be recognized by an Ethernet equipment (3) via said line (L) as a specification of the power class of said terminal (DTE) at which it shall be remotely powered, **characterized in, that** said terminal (DTE) contains a detector (45, 46) coupled to said two center taps (25, 26) able to recognize a specific signal transmitted via said line (L) and notifying to said terminal (DTE) of the incapacity to be remotely powered.

7. Terminal according to claim 6, **characterized in, that** said detector (45, 46) is coupled to some alarm which is activated when recognizing said specific signal.

8. Terminal according to claim 6, **characterized in, that** said detector (45) is connected in parallel to said electrical signature (20) allowing to detect said specific signal being an alternating one.

9. Terminal according to claim 6, **characterized in, that** said detector (46) is connected at the terminals of a rectifier bridge (27) connected at said two center taps (25, 26) allowing to detect said specific signal being a direct one.

10. Ethernet equipment (3) of a local area network LAN with a center tap transformer (32) connected via a line (L) including two pairs of wires (Pp+, Pp-) to a center tap transformer (22) of another Ethernet equipment like a switch, a hub or a terminal (DTE) of said LAN, while said Ethernet equipment (3) contains an electrical circuit connected to two center taps (35, 36) of the transformers (33, 34) of said Ethernet equipment center tap transformer (32), said electrical circuit being able to send a recognition signal to said terminal (DTE) via the line (L) as a measure of an electrical signature (20) specifying a power class of said terminal (DTE) at which it shall be remotely powered, **characterized in, that** said Ethernet equipment (3) contains means coupled to said electrical circuit able to send a specific signal via said line (L) notifying to said terminal (DTE) of the incapacity to be remotely powered, said signal being send when said Ethernet equipment (3) will be unable to supply the required power.

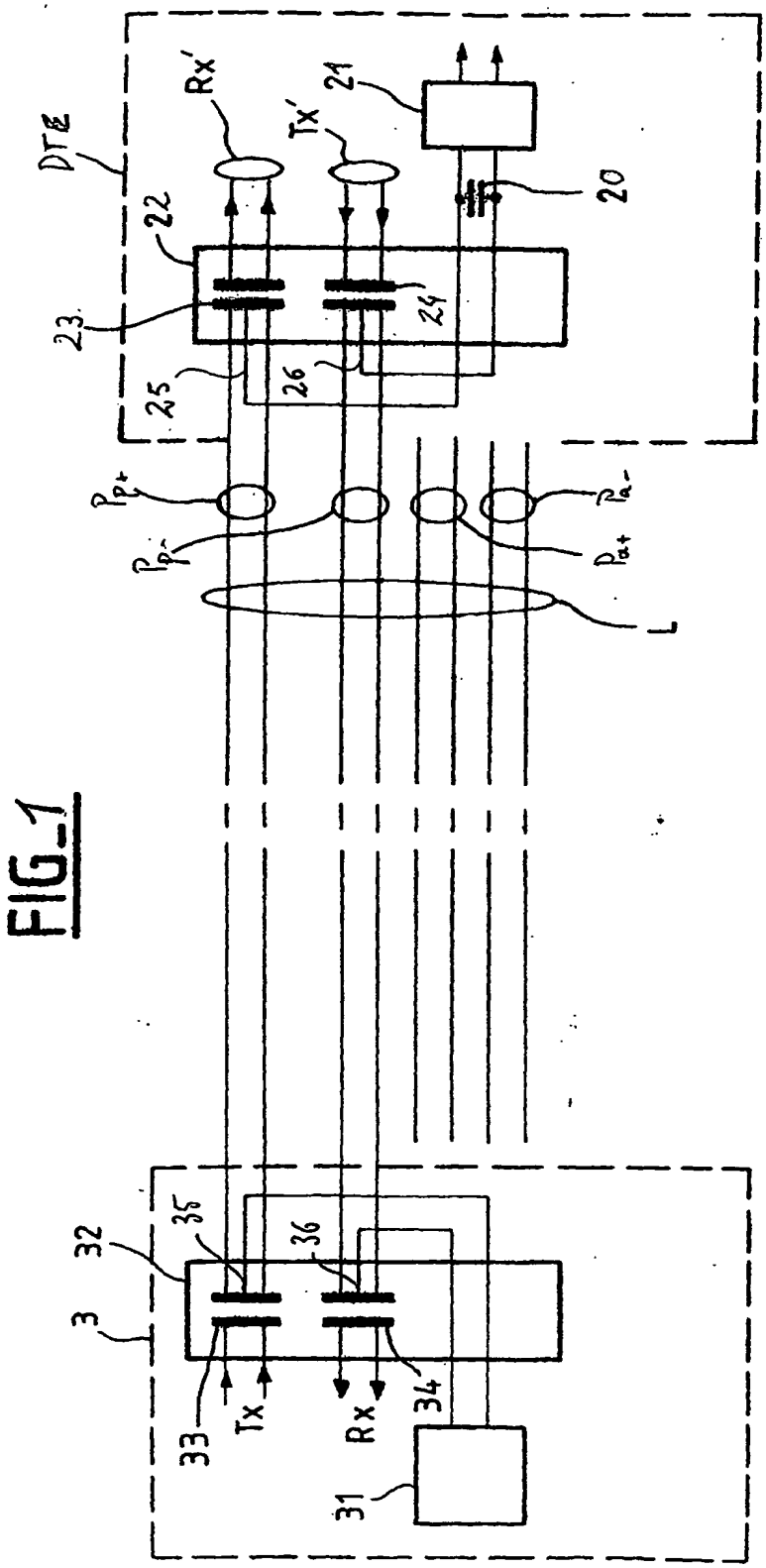

FIG_1

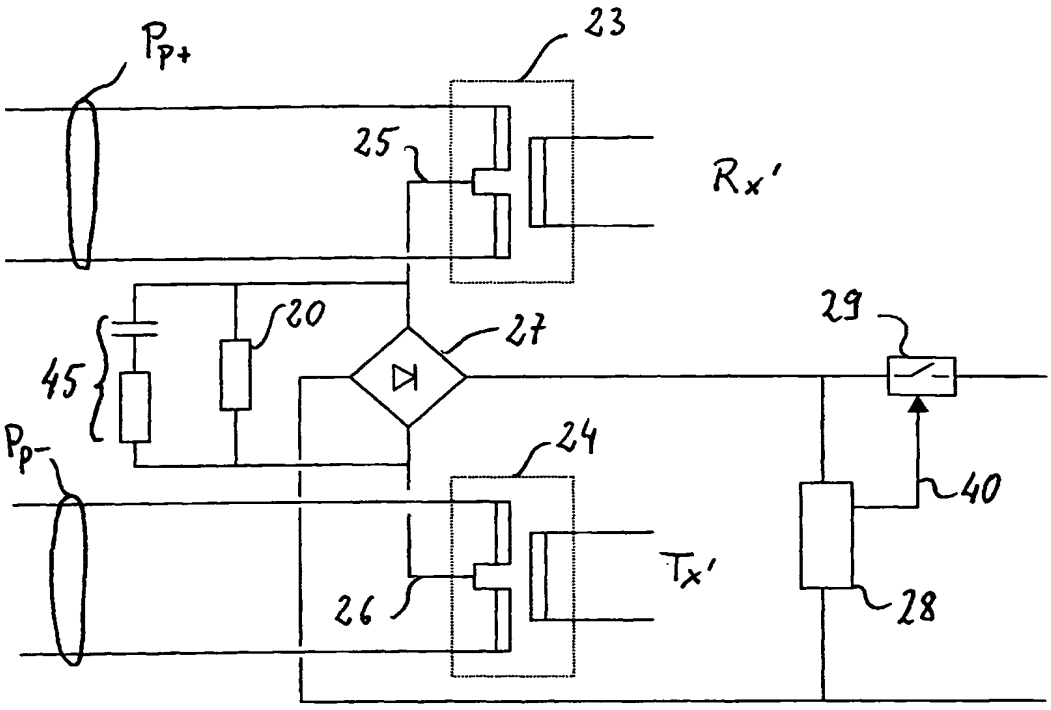

Figure 2

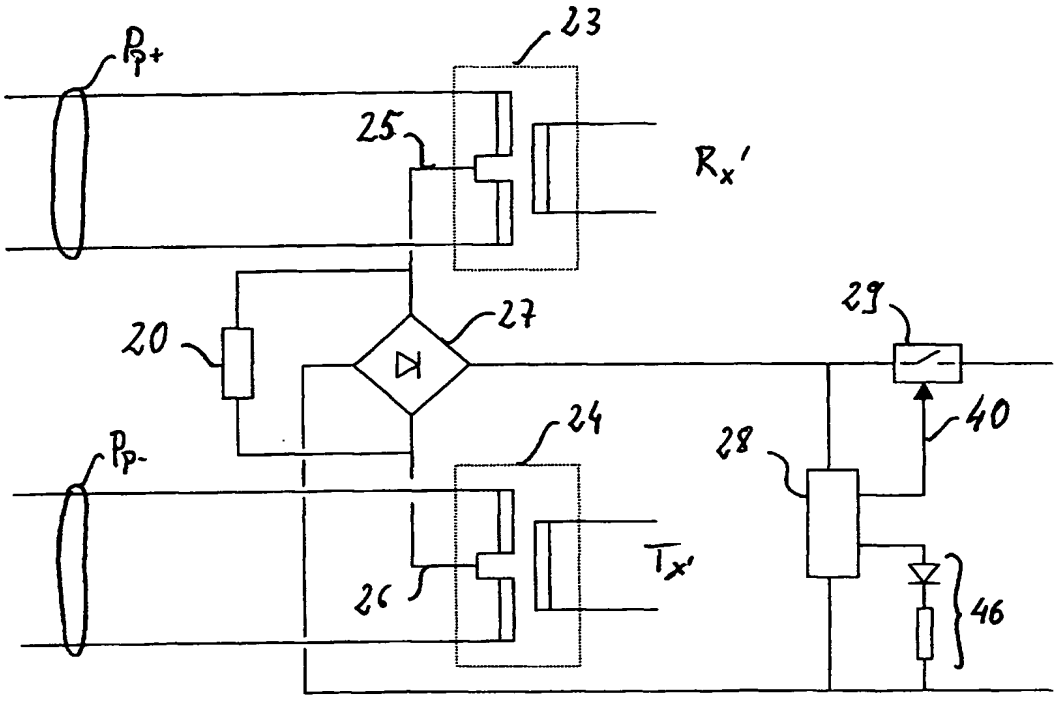

Figure 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 44 0343

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D,A	EP 1 100 226 A (CIT ALCATEL) 16 May 2001 (2001-05-16) * abstract * * paragraph '0008! - paragraph '0010! * * paragraph '0032! - paragraph '0036!; figure 2 *	1,6,10	H04L12/10 H04L12/413
A	US 6 218 930 B1 (DEPTULA JOSEPH A ET AL) 17 April 2001 (2001-04-17) * the whole document *	1,6,10	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 February 2002	Hardelin, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 44 0343

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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22-02-2002

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